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PUBLICATIONS AND GRANTS
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PUBLICATIONS

- Aber, J.D., J.M. Melillo, K.J. Nadelhoffer, J. Pastor and R.D. Boone. 1991. Factors controlling nitrogen cycling and nitrogen saturation in northern temperate forest ecosystems. *Ecological Applications* 1:303-315.
- Agren, G.I., R.E. McMurtrie, W.J. Parton, J. Pastor, and H.H. Shugart. 1991. State-of-the-art of models of production-decomposition linkages in conifer and grassland ecosystems. *Ecological Applications* 1:118-138.
- Ankley, G.T., K. Lodge, D. Call, M. Baker, L. Brooke, R. Johnson, P. Cook, R. Kreis, Jr., A. Carlson, G.J. Niemi, R. Hoke, C. West, J. Giesy and P. Jones. Integrated assessment of contaminated sediments in the lower Fox River and Green Bay, Wisconsin. *Ecotoxicology and Environmental Safety*. In press.
- Axler, R., L. Paulson, R. Vaux, P. Sollberger, and D. Baepler. 1988. Fish Aid: The Lake Mead Fertilization Project. *Lake and Reservoir Management* 4:125-137.
- Axler, R., J. Reuter, D. Slotton and C. Goldman. 1988. Heavy metal distributions and water quality aspects of a newly impounded gold mining reservoir. *Vert. Internat. Verein. Limnol.* 23:968-975.
- Basak, S.C. 1990. A nonempirical approach to predicting molecular properties using graph-theoretic invariants. Pp. 83-103 in W. Karcher and J. DeVillers (eds.), *Practical Applications of Quantitative Structure-Activity Relationships (QSAR) in Environmental Chemistry and Toxicology*. Kluwer Academic Publishers. CWE Contribution #53.
- Basak, S.C. 1988. Binding of barbiturates to Cytochrome P₄₅₀: a QSAR study using log P and topological indices. *Medical Science Research* 16:281-282. CWE Contribution #18.
- Basak, S.C. 1987. Use of molecular complexity indices in predictive pharmacology and toxicology: a QSAR approach. *Medical Science Research* 15:605-609. CWE Contribution #2.
- Basak, S.C. and G.D. Grunwald. Use of graph invariants, volume and total surface area in predicting boiling points of alkanes. *Mathematical and Computer Modelling*. In press.
- Basak, S.C., V.R. Magnuson, G.J. Niemi, and R.R. Regal. 1988. Determining structural similarity using topological indices. *Discrete Applied Mathematics* 19:17-44. CWE Contribution #19.
- Basak, S.C., G.J. Niemi, V.R. Magnuson, R.R. Regal and G.D. Veith. 1987. Topological indices: their nature, mutual relatedness, and applications. *Mathematical Modelling* 8:300-305. CWE Contribution #3.
- Basak, S.C., G.J. Niemi and G.D. Veith. 1991. Predicting properties of molecules using graph invariants. *Journal of Mathematical Chemistry* 78:243-272. CWE Contribution #57.

Basak, S.C., G.J. Niemi and G.D. Veith. 1990. A graph-theoretic approach to predicting molecular properties. *Mathematical and Computer Modelling* 14:511-516. CWE Contribution #52.

Basak, S.C., G.J. Niemi and G.D. Veith. 1990. Optimal characterization of structure for prediction of properties. *Journal of Mathematical Chemistry* 4:185-205. CWE Contribution #64.

Basak, S.C., G.J. Niemi and G.D. Veith. 1990. Recent developments in the characterization of chemical structure. Pp. 235-277 in D.H. Rouvray (ed.), *Computational Chemical Graph Theory*. NOVA Science Publishers, Inc., New York. CWE Contribution #51.

Batterman, A.R., P.M. Cook, D.B. Lothenbach, K.B. Lodge and B.C. Butterworth. 1989. Laboratory determination of relative contributions of water sediment and food chain routes of uptake for 2,3,7,8-TCDD bioaccumulation by lake trout in Lake Ontario. *Chemosphere* 19:451-458.

Binkley, D., J.D. Aber, J. Pastor, and K.J. Nadelhoffer. 1986. Nitrogen availability in some Wisconsin forests: comparisons of resin bags and on-site incubations. *Biology and Fertility of Soils* 2:77-82.

Blake, J.G. 1991. Nested subsets and the distribution of birds in isolated woodlots. *Conservation Biology* 5:58-66. CWE Contribution #56.

Blake, J.G. 1989. Birds of primary forest undergrowth in western San Blas, Panama. *Journal of Field Ornithology* 60:178-179. CWE Contribution #40.

Blake, J.G. 1987. Species-area relationships of winter residents in isolated woodlots. *Wilson Bulletin* 99:243-252.

Blake, J.G., J.M. Hanowski, G.J. Niemi, A.R. Lima and P.T. Collins. 1991. Hourly variation in transect counts of birds: Regional, monthly, and annual effects. *Ornis Fennica* 68: in press.

Blake, J.G. and J.R. Karr. 1987. Breeding birds of isolated woodlots: area and habitat effects. *Ecology* 68:1724-1734. CWE Contribution #4.

Blake, J.G. and B.A. Loiselle. Fruits in the diets of neotropical migrant birds in Costa Rica. *Biotropica*. In press.

Blake, J.G. and B.A. Loiselle. Habitat use by neotropical migrants at La Selva Biological Station and Braulio Carrillo National Park, Costa Rica. In: J.M. Hagan and D.W. Johnston (eds.), *Ecology and Conservation of Neotropical Migrant Landbirds*. Smithsonian Inst. Press, Washington, DC. In press.

Blake, J.G. and B.A. Loiselle. 1991. Variation in resource abundance affects capture rates of birds in three lowland habitats in Costa Rica. *Auk* 108:114-127.

Blake, J.G., B.A. Loiselle, T.C. Moremond, D.J. Levey and J.S. Denslow. 1990. Quantifying abundance of fruits for birds in tropical habitats. *Studies in Avian Biology* 13:73-79. CWE Contribution #43.

Blake, J.G., B.A. Loiselle and J.P. Vande Weghe. Weights and measurements of some Central African birds. *Le Gerfaut* 80:in press.

Blake, J.G., G.J. Niemi and J.M. Hanowski. Drought and annual variation in bird populations: Effects of migratory strategy and breeding habitat. D.W. Johnson and J.M. Hagen (eds.), *Ecology and Conservation of Neotropical Migrant Landbirds*. In press. CWE Contribution #65.

Blake, J.G., F.G. Stiles and B.A. Loiselle. 1990. Birds of La Selva: habitat use, trophic composition, and migrants. Pp. 161-182 in A. Gentry (ed.), *Four neotropical forests*. Yale University Press. CWE Contribution #41.

Bradbury, S.P., R.W. Carlson, G.J. Niemi and T.R. Henry. 1991. Use of respiratory-cardiovascular responses of rainbow trout (*Oncorhynchus mykiss*) in identifying acute toxicity syndromes in fish: Part 4. Central nervous system seizure agents. *Environmental Toxicology and Chemistry* 10:115-131.

Bradbury, S., T. Henry, G.J. Niemi, R.W. Carlson and V.M. Snarski. 1989. Use of respiratory-cardiovascular responses of rainbow trout (*Salmo gairdneri*) in identifying acute toxicity syndromes in fish: Part 3. Polar narcotics. *Environmental Toxicology and Chemistry* 8:247-261. CWE Contribution #20.

Brandt, S.B. and M.E. McDonald. 1987. Homage to speculation: putting fun back into science. *BioScience* 37:771. CWE Contribution #5.

Bridgham, S.D., S.P. Faulkner and C.J. Richardson. 1991. Steel rod oxidation as a hydrologic indicator in wetland soils. *Soil Science Society of America Journal* 55:856-862.

Bridgham, S.D. and C.J. Richardson. Freshwater peatlands on the southeastern Coastal Plain of the USA: Community description, nutrient dynamics, and disturbance. *Proceedings of International Peat Symposium, August 19-23, 1991, Duluth, MN*. In press.

Bridgham, S.D., C.J. Richardson, E. Maltby and S.P. Faulkner. 1991. Cellulose decay in natural and disturbed peatlands in North Carolina. *Journal of Environmental Quality* 20:695-701.

Broschart, M.R., C.A. Johnston and R.J. Naiman. 1989. Prediction of beaver colony density using impounded habitat variables. *Journal of Wildlife Management* 53:929-934. CWE Contribution #45, GIS Contribution #2.

Bryant, J.P., F.D. Provenza, J. Pastor, P.V. Reichardt, T.P. Clausen and J.T. DuToit. 1991. Interactions between woody plants and browsing mammals mediated by secondary metabolites. *Annual Review of Ecology and Systematics* 22:431-446.

Byron, E., R. Axler and C. Goldman. 1991. Increasing precipitation acidity in the Central Sierra Nevada. *Atmospheric Environment* 25A:271-275.

Cohen, Y. and J. Pastor. 1991. The responses of a forest model to different transients of climate change. *Ecology* 72:1161-1165.

Cook, E.R., L.J. Graumlich, P. Martin, J. Pastor, I.C. Prentice, T.R. Swetnam, K. Valentin, M. Verstraete, T. Webb III, J. White and I. Woodward. 1991. Biosphere-climate interactions during the past 18,000 years: Towards a global model of the terrestrial biosphere. Pp. 25-42 in R.S. Bradley (ed.), *Global Changes of the Past*. University Corporation for Atmospheric Research, Boulder, CO.

Davis, F.W., D.A. Quattrochi, M.K. Ridd, N. S-N Lam, S.J. Walsh, J.C. Michaelson, J. Franklin, D.A. Stow, C.J. Johannsen and C.A. Johnston. 1991. Environmental analysis using integrated GIS and remotely sensed data: some research needs and priorities. *Photogrammetric Engineering and Remote Sensing* 57:689-697.

Décamps, H. and R.J. Naiman. 1989. River ecology. *Recherche* 20:310-319. *CWE Contribution #21*.

Detenbeck, N.E. and P.L. Brezonik. 1991. Phosphorus sorption by sediments from a softwater seepage lake: 1. An evaluation of kinetic and equilibrium models. *Environmental Science and Technology* 25:395-402.

Detenbeck, N.E. and P.L. Brezonik. 1991. Phosphorus sorption by sediments from a softwater seepage lake: 2. Effect of pH and sediment composition. *Environmental Science and Technology* 25:403-409.

Detenbeck, N.E., C.A. Johnston and G.J. Niemi. 1991. Use of geographic information systems to assess wetland effects on lake water quality in the Mpls./St. Paul metropolitan area. Pp. 81-85 in *Proceedings of the MN Lake Management Conference, Brainerd, MN, Oct. 1990*.

Detenbeck, N.E., G.J. Niemi, P.W. DeVore and A. Lima. Recovery of stream fish communities from disturbance: A review of case studies and synthesis of theory. *Environmental Management*. In press.

Emanuel, W.R., J. Pastor, and R.V. O'Neill. 1987. Maintaining the integrity of global cycles: requirements for long-term research. Pp. 23-40 in S. Draggen, J.J. Cochrane and R.E. Morrison (eds.), *Preserving Ecological Systems, the Agenda for Long-term Research and Development*. Praeger, New York.

Ford, T.E. and R.J. Naiman. 1989. Groundwater-surface water relationships in boreal forest watersheds: organic carbon and nutrient dynamics. *Canadian Journal of Fisheries and Aquatic Science* 46:41-49.

Ford, T.E. and R.J. Naiman. 1988. Alteration of carbon cycling by beaver - methane evasion rates from boreal forest streams and rivers. *Canadian Journal of Zoology* 66:529-533.

Hanowski, J.M., R.A. Boley and G.J. Niemi. 1990. Probable Wilson's Phalarope breeding in southern Wright County. *Loon* 62:156.

Hanowski, J.M. and G.J. Niemi. 1991. An approach for quantifying habitat characteristics of rare wetland bird breeding areas. Pp. 51-56 in R.S. Mitchell, C.J. Sheviak and D.J. Leopold (eds.), *Ecosystem Management: Rare species and significant habitats*. New York State Museum Bulletin 471, New York State Museum, Albany, NY. *CWE Contribution* #38.

Hanowski, J.M. and G.J. Niemi. 1990. Effects of unknown sex in analyses of foraging behavior. In: M.L. Morrison, D.J. Ralph and J. Verner (eds.), *Food Exploitation by Terrestrial Birds*. University of California, Berkeley, *Studies in Avian Biology* 13:280-283. *CWE Contribution* #22.

Hanowski, J.M. and G.J. Niemi. 1987. Breeding bird populations in a proposed wetland treatment area of northern Minnesota. *Journal of Minnesota Academy of Sciences* 53:7-10. *CWE Contribution* #6.

Hanowski, J.M., G.J. Niemi and J.G. Blake. 1990. Statistical perspectives and experimental design in bird censusing with line transects. *Condor* 92:328-337. *CWE Contribution* #62.

Hansen, A.J., F. di Castri and R.J. Naiman. 1988. Ecotones: what and why? *Biology International* 17:9-46. *CWE Contribution* #23.

Hicks, R. and C.J. Owen. 1991. Bacterial density and activity in benthic nepheloid layers of Lake Michigan and Lake Superior. *Canadian Journal of Fisheries and Aquatic Sciences* 48:923-932.

Hopkinson, C.S., R.D. Fallon, B.O. Jansson and J.P. Schubauer. 1991. Community metabolism on a "live" bottom in the Georgia Bight. *Marine Ecol. Prog. Ser.* 73:105-120.

Host, G.E. 1991. An ecophysiological whole-tree approach to modelling tree growth. Pp. 15-23 in H. Grewel (ed.), *Proceedings of the Forestry Canada Modelling and Climate Change Joint Workshop*. Northern Forestry Centre, Forestry Canada.

Host, G.E., J.G. Isebrands, H.M. Rauscher and D.A. Michael. 1990. Validation of photosynthate production in ECOPHYS, an ecophysical growth process model of Populus. *Tree Physiology* 7:283-296.

Host, G.E. and K.S. Pregitzer. 1991. Ecological species groups for upland forest ecosystems of northwestern Lower Michigan. *Forest Ecology and Management* 43:87-102.

Host, G.E. and H.M. Rauscher. 1990. Validating the regional applicability of a whole-plant growth process model of juvenile poplar. Pp. 97-106 in L. Wensel and G. Biging (eds.), Forest Simulation Systems: Proceedings of the IUFRO Conference, Nov. 2-5, 1988, Berkeley, CA.

Hunter, R., G. Niemi, A. Pilli and G. Veith. 1990. Aquatic information and retrieval data base (AQUIRE). Pp. 42-48 in W. Pillman (ed.), Envirotech Vienna 1990, Computer applications for environmental impact analysis. International Society of Environmental Protection, Vienna, Austria.

Johnson, L.B. 1990. Analyzing spatial and temporal phenomena using geographic information systems: A review of ecological applications. Landscape Ecology 4:31-43. CWE Contribution #47, GIS Contribution #3.

Johnson, L.B., G.E. Host, J.K. Jordan and L.L. Rogers. 1991. Use of GIS for landscape design in natural resource management: Habitat assessment and management for the female black bear. Pp. 507-517 in Proceedings of the GIS/LIS '91, Atlanta, GA.

Johnson, L.B., C.A. Johnston and J. Pastor. 1988. Raster and vector data in ecological research applications. Pp. 386-394 in GIS/LIS '88 Proceedings, San Antonio, TX.

Johnson, M., S.C. Basak and G. Maggiora. 1988. A characterization of molecular similarity methods for property prediction. Mathematical and Computer Modelling 11:630-634. CWE Contribution #26.

Johnston, C.A. 1991. Sediment and nutrient retention by freshwater wetlands: effects on surface water quality. Critical Reviews in Environmental Control 21:491-565. CWE Contribution #77.

Johnston, C.A. 1991. GIS Technology in Ecological Research. Encyclopedia of Earth System Science, Vol. 2:329-346. Academic Press, San Diego, CA. CWE Contribution #66, GIS Contribution #10.

Johnston, C.A. 1990. GIS: More than just a pretty face. Landscape Ecology 4:3-4.

Johnston, C.A. 1989. Ecological research applications of geographic information systems. GIS/LIS '89 Proceedings, Nov. 26-30, Orlando, FL.

Johnston, C.A. 1989. Human impacts to Minnesota wetlands. Journal of the Minnesota Academy of Science 55:120-124. CWE Contribution #46.

Johnston, C.A. Land use activities and western Lake Superior water quality. Proceedings of Making a Great Lake Superior - Lake Superior Water Quality: Remedial Action Plans in the Basin. Lakehead University, Thunder Bay, Canada. In press.

Johnston, C.A. Introduction to quantitative methods and modeling in community, population, and landscape ecology. First International Conference/Workshop on Integrating Geographic Information Systems and Environmental Modeling, Boulder, CO. 15-18 September 1991. In press.

Johnston, C.A. Mechanisms of wetland-water quality interaction. *Constructed Wetlands for Water Quality Improvement*. Lewis Press, Chelsea, MI. In press.

Johnston, C.A. and J.P. Bonde. 1989. Quantitative analysis of ecotones using a geographic information system. *Photogrammetric Engineering and Remote Sensing* 55:1643-1647. CWE Contribution #49, GIS Contribution #6.

Johnston, C.A., N.E. Detenbeck, J.P. Bonde, and G.J. Niemi. 1988. Geographic information systems for cumulative impact assessment. *Photogrammetric Engineering & Remote Sensing* 54:1609-1615. CWE Contribution #24, GIS Contribution #1.

Johnston, C.A., N.E. Detenbeck, and G.J. Niemi. 1990. The cumulative effect of wetlands on stream water quality and quantity: A landscape approach. *Biogeochemistry* 10:105-141. CWE Contribution #25, GIS Contribution #8.

Johnston, C.A., B. Marlett, and M. Riggle. 1988. Application of a computer-automated wetlands inventory to regulatory and management problems. *Wetlands* 8:43-52.

Johnston, C.A. and R.J. Naiman. 1990. The use of a geographic information system to analyze long-term landscape alteration by beaver. *Landscape Ecology* 4:5-19. CWE Contribution #37, GIS Contribution #4.

Johnston, C.A. and R.J. Naiman. 1990. Browse selection by beaver: Effects on riparian forest composition. *Canadian Journal of Forest Research* 20:1036-1043. CWE Contribution #60.

Johnston, C.A., and R.J. Naiman. 1990. Aquatic patch creation in relation to beaver population trends. *Ecology* 71:1617-1621. CWE Contribution #50, GIS Contribution #7.

Johnston, C.A. and R.J. Naiman. 1987. Boundary dynamics at the aquatic-terrestrial interface: The influence of beaver and geomorphology. *Landscape Ecology* 1:47-57. CWE Contribution #7.

Johnston, C.A., J. Pastor and R.J. Naiman. Effects of beaver and moose on boreal forest landscapes. In: S.H. Cousins, R. Haines-Young and D. Green (eds.), *Landscape Ecology and Geographical Information Systems*. Taylor-Francis, London. In press. CWE Contribution #76, GIS Contribution #13.

Johnston, C.A., J. Pastor, and G. Pinay. 1992. Quantitative methods for studying landscape boundaries. Pp. 107-125 in F. di Castri and A. Hansen (eds.), *Landscape Boundaries: Consequences for Biotic Diversity and Ecological Flows*. Springer-Verlag, New York. CWE Contribution #58, GIS Contribution #9.

Karr, J.R., S.K. Robinson, J.G. Blake and R.O. Bierregaard, Jr. 1990. The avifauna of four neotropical forests. Pp. 237-269 in A. Gentry (ed.), Four neotropical forests. Yale University Press. CWE Contribution #42.

Kouki, J., G.J. Niemi and A. Rajasarkka. 1992. Breeding populations and habitat associations of birds in peatlands of eastern Finland. *Ornis Fennica*: in press.

Lodge, K.B. 1989. Solubility studies using a generation column for 2,3,7,8-tetrachlorodibenzo-p-dioxin. *Chemosphere* 18:933-940.

Lodge, K.B. and P.M. Cook. 1989. Partitioning studies of dioxin between sediment and water: The measurement of K_{oc} of Lake Ontario sediments. *Chemosphere* 19:439-444.

Loiselle, B.A. 1990. Seeds in droppings of tropical fruit-eating birds: Importance of considering seed composition. *Oecologia* 82:494-500.

Loiselle, B.A. and J.G. Blake. 1992. Spatial dynamics of understory avian frugivores and fruiting plants in lowland wet tropical forest. In: A. Estrada and T. Fleming (eds.), *Frugivores and seed dispersal*. Dr. W. Junk, Publ., Dordrecht, The Netherlands.

Loiselle, B.A. and J.G. Blake. 1991. Resource abundance and temporal variation in fruit-eating birds and along a wet forest elevational gradient in Costa Rica. *Ecology* 72:180-193.

Loiselle, B.A. and J.G. Blake. Diets of understory fruit-eating birds in Costa Rica. *Studies in Avian Biology* 13:91-103.

Loiselle, B.A., J.G. Blake, T.C. Moermond and D.J. Mason. 1989. Low elevation record for Resplendent Quetzals (*Pharomachrus mocinno*) in Costa Rica. *Journal of Field Ornithology* 60:86-88. CWE Contribution #39.

McDowell, D.M. and R.J. Naiman. 1986. Structure and function of a benthic invertebrate stream community influenced by beaver (*Castor canadensis*). *Oecologia* 68:481-489.

McKim, J.M., S.P. Bradbury and G.J. Niemi. 1987. Fish acute toxicity syndromes and their use in the QSAR approach to hazard assessment. *Environmental Health Perspectives* 71:171-186. CWE Contribution #11.

McKim, J.M., P.K. Schneider, R.W. Carlson, E.P. Hunt and G.J. Niemi. 1987. Use of respiratory-cardiovascular responses of rainbow trout (*Salmo gairdneri*) in developing fish acute toxicity syndromes. Part I. Pentachlorophenol 2,4-dinitrophenol, tricaine methane sulfonate, and 1-octanol. *Environmental Toxicology and Chemistry* 6:295-312. CWE Contribution #9.

McKim, J.M., P.K. Schneider, G.J. Niemi, R.W. Carlson and T.R. Henry. 1987. Use of respiratory-cardiovascular responses of rainbow trout (*Salmo gairdneri*) in developing fish acute toxicity syndromes. Part II. Malathion, carbaryl, acrolein, and benzaldehyde. *Environmental Toxicology and Chemistry* 6:313-328. CWE Contribution #10.

McLellan, T.M., M.E. Martin, J.D. Aber, J.M. Melillo, K.J. Nadelhoffer and B. Dewey. 1991. Comparison of wet chemistry and near infrared reflectance measurements of carbon-fraction chemistry and nitrogen concentration of forest foliage. *Canadian Journal of Forest Research* 21:1689-1693.

Mladenoff, D.J. 1991. Book reviews: Wildlife, forests and forestry: principles of managing forests for biological diversity; M.H. Hunter. Americans and their forests: a historical geography; M. Williams. *Ecology* 72:363-365.

Mladenoff, D.J. 1990. Book review: Protecting the New Jersey Pinelands. B.R. Collins and E.W.B. Russell (eds.), *Ecology* 71:833-834.

Mladenoff, D.J. 1990. A Pacific Northwest endemic, Disporum hookeri, in Michigan. *Michigan Botanist* 29:97-102. CWE Contribution #59.

Mladenoff, D.J. 1990. The relationship of the soil seed bank and vegetation layers to disturbance regime in a northern hardwood-hemlock forest. *Canadian Journal of Botany* 68:2714-2721.

Moen, R.J., J. Pastor and Y. Cohen. 1990. Effects of moose and beaver on the vegetation of Isle Royale National Park. *Alces* 26:51-63. CWE Contribution #74.

Naiman, R.J. 1987. The role of ecotones in landscape management. UNESCO-Man and the Biosphere Program.

Naiman, R.J. 1988. Animal influences on ecosystem dynamics. *BioScience* 38:750-752.

Naiman, R.J., H. Décamps, J. Pastor and C.A. Johnston. 1988. The potential importance of boundaries to fluvial ecosystems. *Journal of the North American Benthological Society* 7:289-306. CWE Contribution #28.

Naiman, R.J., M.M. Holland, H. Décamps and P.G. Risser. 1988. A new UNESCO Programme: research and management of land/inland-water ecotones. *Biology International* 17:107-136. CWE Contribution #29.

Naiman, R.J., C.A. Johnston and J.C. Kelley. 1988. Alteration of North American streams by beaver. *BioScience* 38:753-762. CWE Contribution #27.

Naiman, R.J., T. Manning and C.A. Johnston. 1991. Beaver population fluctuations and tropospheric methane emissions in boreal wetlands. *Biogeochemistry* 12:1-15. CWE Contribution #63.

Naiman, R.J., S.D. McCormick, W.L. Montgomery and R. Morin. 1987. Anadromous brook charr, Salvelinus fontinalis - opportunities and constraints for population enhancement. *Marine Fisheries Review* 49:1-13.

Naiman, R.J., J.M. Melillo and J.E. Hobbie. 1986. Ecosystem alteration of boreal forest streams by beaver (Castor canadensis). *Ecology* 67:1254-1269.

Naiman, R.J., J.M. Melillo, M.A. Lock, T.E. Ford and S.R. Reice. 1987. Longitudinal patterns of ecosystem processes and community structure in a subarctic river continuum. *Ecology* 68:1139-1156.

Niemi, G.J. 1990. Multivariate analysis and QSAR: Applications of principal components analysis. Pp. 153-169 in W. Karcher and J. DeVillers (eds.), *Practical Applications of Quantitative Structure-Activity Relationships (QSAR) in Environmental Chemistry and Toxicology*. Kluwer Academic Publishers, Dordrecht, The Netherlands.

Niemi, G.J. 1987. Breeding birds at Hovland Woods, northern Minnesota. *Loon* 59:36-41.

Niemi, G.J. 1985. Patterns of morphological evolution in bird genera of New World and Old World peatlands. *Ecology* 66:1215-1228.

Niemi, G.J., S. Basak and G. Veith. 1989. A theoretical and computational approach to chemical evaluation based on structure-activity relationships. Pp. 57-68 in K. Zirm and J. Mayer (eds.), *Envirotech Vienna 1989*, Vol. 2, No. 1. Federal Environmental Protection Agency, Vienna. WB. Druck Gmbh. and Co., Reiden, Austria.

Niemi, G.J., S.C. Basak, G.D. Veith and G. Grunwald. Prediction of octanol/water partition coefficient (K_{ow}) using algorithmically-derived variables. *Environmental Toxicology and Chemistry*: in press.

Niemi, G.J., T.E. Davis and G.D. Veith. 1986. Organochlorine residues in the herring gull, ring-billed gull, and common tern of western Lake Superior. *Archives of Environmental Contamination and Toxicology* 15:313-320. CWE Contribution #1.

Niemi, G.J., P. DeVore, N. Detenbeck, D. Taylor, J.D. Yount, A. Lima, J. Pastor and R.J. Naiman. 1990. An overview of case studies on recovery of aquatic systems from disturbance. *Environmental Management* 14:571-587. CWE Contribution #72.

Niemi, G.J. and J.M. Hanowski. Chapter 3. Birds of Minnesota peatlands. In: H. Wright, Jr., B. Coffin and N. Aaseng (eds.), *The patterned peatlands of northern Minnesota*. University of Minnesota Press, Minneapolis, MN. In press. CWE Contribution #31.

Niemi, G.J. and J.M. McKim. 1988. Simplifying complex QSARs in toxicity studies with multivariate statistics. Pp. 11-19 in *Proceedings of QSAR88, the Third International Workshop on Quantitative Structure-Activity Relationships in Environmental Toxicology*. Knoxville, TN, USA. CWE Contribution #32.

Niemi, G.J., J.M. McKim and S.P. Bradbury. The use of fish physiology literature for predicting fish acute toxicity syndromes. *American Society for Testing and Materials*. In press. CWE Contribution #68.

Niemi, G.J. and J.R. Probst. 1990. Wildlife and fire in the Lake States. Pp. 33-49 in J.M. Sweeney (ed.), *Management of Dynamic Ecosystems*. North Cent. Sect., The Wildlife Soc., West Lafayette, IN.

Niemi, G.J., R.R. Regal and G.D. Veith. 1985. The use of molecular connectivity indices and multivariate analysis in environmental chemistry. Pp. 148-159 in J.J. Breen and P.E. Robinson (eds.), Environmental Applications of Chemometrics. American Chemical Society Series: 292, Washington, DC.

Niemi, G.J. and G.D. Veith. 1989. An approach for development of structure biodegradation relationships of organic chemicals. Pp. 459-467 in G.S. Suter II and M.A. Lewis (eds.), Aquatic Toxicology and Environmental Fate: Eleventh Volume. ASTM STP 1007. American Society for Testing and Materials, Philadelphia. CWE Contribution #30.

Niemi, G.J., G.D. Veith, R.R. Regal and D.D. Vaischnav. 1987. Structural features associated with persistent and degradable chemicals. Environmental Toxicology and Chemistry 6:515-527.

Norby, R.J., J. Pastor and J.M. Melillo. 1986. Carbon-nutrient interactions in response to CO₂ enrichment: physiological and long-term perspectives. Tree Physiology 2:233-242.

O'Neill, R.V., D.L. DeAngelis, J. Pastor, B.J. Handley and W.M. Post. 1989. Multiple nutrient limitation in ecological processes. Ecological Modelling 46:147-163.

Pastor, J. 1988. Soil-plant relationships: A Gordian knot remains tied (book review). Ecology 69:874.

Pastor, J. 1987. The Lake States forests of the future. Pp. 89-93 in Proceedings, Society of American Foresters Annual Meeting, Minneapolis, MN.

Pastor, J. 1986. Nutrient regimes in northern hardwoods: harvest intensity and nutrient status. Pp. 98-108 in G.D. Mroz and D.D. Reed (eds.), The Northern Hardwood Resource: Management and Potential. Michigan Technological University, Houghton, MI.

Pastor, J. 1986. Reciprocally linked carbon-nitrogen cycles in forests: biological feedbacks within geological constraints. Pp. 131-140 in G.I. Agren (ed.), Predicting consequences of intensive forest harvesting on long-term productivity. Swedish University of Agricultural Sciences Report No. 26.

Pastor, J. and M.R. Broschart. 1990. The spatial pattern of a northern conifer hardwood landscape. Landscape Ecology 4:55-68. CWE Contribution #48, GIS Contribution #5.

Pastor, J. and Y. Cohen. 1991. Integrating ecosystem and landscape ecology using simulation models and geographic information systems. In: R.J. Naiman and J. Sedell (eds.), New Perspectives for Watershed Management. Springer-Verlag. CWE Contribution #69, GIS Contribution #11.

Pastor, J., B. Dewey, R.J. Naiman, P.F. McInnes and Y. Cohen. Moose browsing and soil fertility in the boreal forests of Isle Royale National Park. Ecology. In press.

Pastor, J., R.H. Gardner, V.H. Dale, and W.M. Post. 1987. Successional changes in soil nitrogen availability as a potential factor contributing to spruce dieback in boreal North America. *Canadian Journal of Forest Research* 17:1394-1400. CWE Contribution #16.

Pastor, J. and M. Huston. 1986. Predicting ecosystem properties from physical data: a case study of nested soil moisture-climatic gradients along the Appalachian chain. In: M.I. Dyer and D.A. Crossley (eds.), *MAB Workshop on coupling of ecological studies on three U.S. Forest Service Research Sites with remote sensing studies*, Athens GA.

Pastor, J. and C.A. Johnston. Using simulation models and geographic information systems to integrate ecosystem and landscape ecology. In: R.J. Naiman and J.R. Sedell (eds.), *New Perspectives in Watershed Management*. Springer-Verlag, New York. In press.

Pastor, J. and D.J. Mladenoff. 1991. The southern boreal-northern hardwood forest border. In: H.H. Shugart, R. Leemans and G.B. Bonan (eds.), *A Systems Analysis of the Global Boreal Forest*. Cambridge University Press.

Pastor, J. and R.J. Naiman. Selective forage and ecosystem processes in boreal regions. *American Naturalist*. In press.

Pastor, J., R.J. Naiman, and B. Dewey. 1987. A hypothesis of the effects of moose and beaver foraging on soil nitrogen and carbon dynamics, Isle Royale. *Alces* 23:107-124. CWE Contribution #17.

Pastor, J., R.J. Naiman, B. Dewey, and P. McInnes. 1988. Moose, microbes, and the boreal forest. *BioScience* 38:770-777. CWE Contribution #34.

Pastor, J. and W.M. Post. 1988. Response of northern forests to CO₂-induced climatic change. *Nature* 334:55-58. CWE Contribution #33.

Pastor, J., and W.M. Post. 1986. Influence of climate, soil moisture, and succession on forest carbon and nitrogen cycles. *Biogeochemistry* 2:3-27.

Pastor, J., M.A. Stillwell, and D. Tilman. 1987. Little bluestem litter dynamics in Minnesota old fields. *Oecologia* 72:327-330. CWE Contribution #15.

Pastor, J., M.A. Stillwell and D. Tilman. 1987. Nitrogen mineralization and nitrification in four Minnesota old fields. *Oecologia* 71:481-485. CWE Contribution #14.

Post, W.M. and J. Pastor. 1990. An individual-based forest ecosystem model for projecting forest response to nutrient cycling and climate changes. Pp. 61-74 in L.C. Wensel and G.S. Biging (eds.), *Forest Simulation Systems*. University of California, Division of Agriculture and Life Sciences, Bulletin 1927.

Post, W.M., J. Pastor, P. Zinke, and A. Stangenberger. 1985. Global patterns of soil nitrogen storage. *Nature* 317:613-616.

Pringle, C.M., R.J. Naiman, G. Bretschko, J.R. Karr, M.W. Oswood, J.R. Webster, R.L. Welcomme and M.J. Winterbourn. 1988. Patch dynamics in lotic systems - the stream as a mosaic. *Journal of the North American Benthological Society* 7:503-524.

Rauscher, H.M. and G.E. Host. 1990. Hypertext and AI: a complementary combination for knowledge management. *AI Applications in Natural Resource Management* 4:58-61.

Rauscher, H.M., J.G. Isebrands, G.E. Host, R.E. Dickson, D.I. Dickmann, T.R. Crow and D.A. Michael. 1990. ECOPHYS: an ecophysiological growth process model of poplar. *Tree Physiology* 7:255-281.

Reice, S.R., R.C. Wissmar and R.J. Naiman. 1990. Disturbance regimes, resilience, and recovery of animal communities and habitats in lotic ecosystems. *Environmental Management* 14:647-659.

Reuter, J.E. and R.P. Axler. 1988. A comparison of methodologies used to measure nutrient uptake by periphyton. *Verh. Internat. Verein. Limnol.* 23:915-918.

Reuter, J. and R.P. Axler. Physiological characteristics of inorganic nitrogen uptake by spatially separate algal communities in an N-deficient lake. *Freshwater Biology*. In press.

Richards, C. 1991. An overview of ecological assessment and restoration tools. In *Workshop on the water quality based approach for point source and nonpoint source controls. Meeting Summary*. Environmental Protection Agency. Washington, DC. EPA 503/9-92-001.

Richards, C. Integrated watershed analysis and study design. In E. Herricks (ed.) *Urban runoff and receiving systems: an interdisciplinary analysis of impact, monitoring, and management*. Engineering Foundation, New York. In press.

Richards, C. and P.J. Cernera. 1991. Coordination and cooperation: Keys to habitat rehabilitation. *Proceedings of the Symposium on Indian Fisheries*. American Fisheries Society Spec. Publ.

Richards, C. and P.J. Cernera. 1989. The movements and abundance of hatchery and wild juvenile chinook salmon in an Idaho stream. *North American Journal of Fisheries Management* 9:345-351.

Richards, D., P.J. Cernera, M. Ramey and D. Reiser. Utilization of off-channel dredge ponds to increase juvenile chinook salmon rearing habitat. *North American Journal of Fisheries Management*. In press.

Richards, C., P.J. Cernera, M.P. Ramey and D.W. Reiser. Development of off-channel habitat for use by juvenile chinook salmon. *North American Journal of Fisheries Management*. In press.

Veith, G., B. Greenwood, G. Niemi, R. Hunter and R. Regal. 1988. On the intrinsic dimensionality of chemical structure space. *Chemosphere* 17:1617-1630.

Wallace, K.D. and G.J. Niemi. 1988. Chemical determinants of error in extrapolating acute toxicity between fish and rodents. *Environmental Toxicology and Chemistry* 7:201-212. CWE Contribution #36.

Walsh, G., R. Morin and R.J. Naiman. 1988. Daily rations, diel feeding-activity and distribution of age-0 brook charr, *Salvelinus fontinalis*, in two subarctic streams. *Environmental Biology of Fishes* 21:195-205.

Yount, J.D. and G.J. Niemi (eds.). 1990. Preface to Recovery of lotic communities and ecosystems following disturbance: theory and application. *Environmental Management* 14:515-516. CWE Contribution #73.

Yount, J.D. and G.J. Niemi. 1990. Recovery of lotic communities and ecosystems from disturbance—a narrative review of case studies. *Environmental Management* 14:547-569. CWE Contribution #71.

Zak, D.R., G.E. Host and K.S. Pregitzer. 1989. Regional variability in nitrogen, mineralization, nitrification, and overstory biomass in northern Lower Michigan. *Canadian Journal of Forest Research* 19:1521-1526.

Zehr, J.P., S.G. Paulsen, R.P. Axler and C.R. Goldman. 1988. Dynamics of dissolved organic nitrogen in subalpine Castle Lake, CA. *Hydrobiologia* 157:33-45.

PUBLICATIONS (Submitted)

Blake, J.G., J.M. Hanowski and G.J. Niemi. Correlation between birds and habitat: Annual variation in species habitat relationships. Submitted to *Condor*.

Blake, J.G. and B.A. Loiselle. Capture rates of birds in three lowland habitats in Costa Rica: temporal variation and resource abundance. In final revision for *Auk*.

Bridgham, S.D. and C.J. Richardson. Freshwater peatlands on the southeastern Coastal Plain of the USA: Community descriptions, nutrient dynamics, and disturbance. Submitted to Proceedings of 1991 International Peat Symposium, Duluth, MN.

Bridgham, S.D. and C.J. Richardson. Mechanisms controlling soil respiration (carbon dioxide and methane) in subtropical peatlands. Submitted to *Science*.

Hanowski, J.M., J.G. Blake and G.J. Niemi. Seasonal abundance and composition of bird communities adjacent to forest edges in northern hardwood forests, USA. Submitted to *Ornis Scandinavica*.

Hanowski, J.M., J.G. Blake, G.J. Niemi and P.T. Collins. Effects of extremely low frequency electromagnetic fields on breeding and migrating bird species and communities. Submitted to *American Midland Naturalist*.

Hanowski, J.M. and G.J. Niemi. Effects of two mosquito control agents on growth and reproduction of Red-winged Blackbirds (Agelaius phoeniceus). Submitted to The Condor.

Hanowski, J.M. and G.J. Niemi. Bird abundance and species composition in a northern Minnesota wetland before-and-after addition of sewage effluent. Submitted to Journal of Minnesota Academy of Science.

Hanowski, J.M. and G.N. Niemi. Experimental design and statistical considerations for establishing a habitat specific regional monitoring program using point counts. Submitted to Ralph et al. (eds.), Point Count Standards.

Hanowski, J.M., G.J. Niemi and J.G. Blake. Effects of aspen strip-thinning on breeding birds in Minnesota. Submitted to Wildlife Society Bull.

Host, G.E. and K.S. Pregitzer. Geomorphic influences on ground-flora and overstory composition in upland forests of northwestern Lower Michigan. Submitted to Canadian Journal of Forest Research.

Host, G.E., H.M. Rauscher and D. Schmoltdt. SYLVATICA: An integrated framework for forest landscape simulation. Submitted to Landscape and Urban Planning.

Host, G.E., R.R. Regal and C.E. Stephan. Analyses of acute and chronic data for aquatic life. Submitted to National Technical Information Service.

Johnston, C.A. Material fluxes across wetland ecotones in northern landscapes. Submitted to Ecological Applications.

Jones, P.D., J.P. Geisy, J.L. Newsted, D.A. Verbrugge, D.L. Beaver, G.T. Ankley, D.E. Tillitt and K.B. Lodge. Determination of 2,3,7,8-tetrachlorodibenzo-p-dioxin equivalents in tissues of birds at Green Bay, WI, USA. Submitted to Environmental Toxicological Chemistry.

Kutka, F.J., C. Richards, G.W. Merrick, P.W. DeVore and M.E. McDonald. Bait preference of two common crayfishes of northern Minnesota. Submitted to Progressive Fish-Culturist.

McInnes, P.F., R.J. Naiman, J. Pastor and Y. Cohen. Effects of moose browsing on vegetation and litterfall of the boreal forest, Isle Royale, MI. Ecology. In review.

Mladenoff, D.J., M.A. White, J. Pastor and T.R. Crow. Comparing spatial pattern in unaltered old-growth and disturbed forest landscapes for biodiversity and management. Submitted to Ecological Applications.

Pastor, J. and W.M. Post. Climate warming and the potential changes to the carbon and nitrogen cycles of eastern North America. Submitted to Nature.

Richards, C. and K.L. Bacon. Influence of fine sediment, vertical placement, and longitudinal location on the colonization of stream macroinvertebrates. Submitted to Great Basin Naturalist.

Richards, C., G. Host and J. Arthur. Relative influences of water chemistry and physical habitat in structuring macroinvertebrate communities in a midwestern agricultural catchment. Submitted to Freshwater Biology.

Richards, C. and G.W. Minshall. Spatial and temporal trends in stream macroinvertebrate communities: The influence of watershed disturbance. Submitted to Hydrobiologia.

Schubauer-Berigan, J.P. 1991. In situ measurements of nitrogen and phosphorus release by tropical marine sponges in Jamaica. Submitted to Limnology and Oceanography.

TECHNICAL REPORTS

Axler, R., C. Rose and C. Tikkanen. 1991. An assessment of phytoplankton nutrient deficiency in northern Minnesota acid sensitive lakes. (December 1991) Submitted to Minnesota Pollution Control Agency. NRRI Tech. Rep. NRRI/TR-91-18.

Blake, J.G., J.M. Hanowski and G.J. Niemi. 1988. ELF communications system ecological monitoring program: bird species and communities. In: Compilation of 1987 Annual Reports of the Navy ELF Communications System Ecological Monitoring Program, Technical Report E06595-2, Contract No. N00039-88-C-0065. 175 pp.

Blake, J.G., J.M. Hanowski and G.J. Niemi. 1989. ELF communications system ecological monitoring program: bird species and communities. In: Compilation of 1988 Annual Reports of the Navy ELF Communications System Ecological Monitoring Program, Technical Report E06595-6, Contract No. N00039-88-C-0065. 98 pp.

Blake, J.G., J.M. Hanowski and G.J. Niemi. 1990. ELF communications system ecological monitoring program: bird species and communities. In: Compilation of 1989 Annual Reports of the Navy ELF Communications System Ecological Monitoring Program, Technical Report E06595, Contract No. N00039-88-C-0065. 99 pp.

Blake, J.G., J.M. Hanowski, G.J. Niemi and P.T. Collins. 1991. ELF communications system ecological monitoring program: bird species and communities. In: Compilation of 1990 Annual Reports of the Navy ELF Communications System Ecological Monitoring Program, Technical Report E06549-84-011, Contract No. N00039-88-C-0065. 99 pp.

Blake, J.G., J.M. Hanowski, G.J. Niemi and P.T. Collins. 1992. ELF communications system ecological monitoring program: bird species and communities. In: Compilation of 1991 Annual Reports of the Navy ELF Communications System Ecological Monitoring Program, Technical Report E06549-84-011, Contract No. N00039-88-C-0065. Submitted.

Detenbeck, N.E., C.A. Johnston and G.J. Niemi. 1988. The effect of wetlands on lake water quality: a landscape approach. Final report to the US EPA, Corvallis Environmental Research Laboratory. Cooperative Agreement No. CR-814083.

Detenbeck, N.E., C.A. Johnston, D.A. Taylor, A. Lima, C. Hagley and S. Bamford. 1991. Effects of disturbance on water-quality functions of wetlands. Final report to US EPA Environmental Research Laboratory, Duluth, MN.

Hanowski, J.M., J.G. Blake, G.J. Niemi and P.T. Collins. 1990. ELF communications system ecological monitoring program: bird species and communities, Wisconsin test facility. Final Report, Subcontract No. E06549-84-011, Navy ELF Communications System Ecological Monitoring Program, Contract No. N00039-88-C-0065. 107 pp.

Haowski, J.M. and G.J. Niemi. 1992. Progress Report: Evaluation of the effects of methoprene and BTI on non-target organisms. A summary of Red-winged Blackbird and bird community studies before-and-after one year of treatment. Report to Metropolitan Mosquito Control District. NRRI/92/01.

Hanowski, J.M. and G.J. Niemi. 1991. Monitoring bird populations on National Forest lands: Chippewa National Forest, 1991. CNF Report No. 1, NRRI-TR-91-20.

Haowski, J.M. and G.J. Niemi. 1991. Monitoring bird populations on National Forest lands: Superior National Forest, 1991. SNF Report No. 1, NRRI-TR-91-21.

Hanowski, J.M. and G.J. Niemi. 1989. Bird populations and communities in a northern Minnesota wetland before-and-after addition of sewage effluent. Report to J. Baker Engineering, Inc. 20 pp.

Hanowski, J.M. and G.J. Niemi. 1986. Habitat characteristics for bird species of special concern. Report to Department of Natural Resources, Minerals and Nongame Division. University of Minnesota. 47 pp.

Hanowski, J.M. and G.J. Niemi. 1985. Assessment of the effects of the ELF antenna system on bird species and communities. Report to Illinois Institute of Technology. 59 pp.

Hanowski, J.M., G.J. Niemi and J.G. Blake. 1990. An assessment of the effects of aspen strip thinning on breeding birds in northern Minnesota. Report to BioProducts Division, NRRI.

Hanowski, J.M., G.J. Niemi and J.G. Blake. 1987. ELF communications system ecological monitoring program: bird species and communities. In: Compilation of 1986 Annual Reports of the Navy ELF Communications System Ecological Monitoring Program, July 1987; Technical Report E06549-38, Contract No. N00039-84-C-0070. 117 pp.

Hershey, A., L. Shannon and R. Axler. 1991. Effects of methoprene and BTI on non-target invertebrates: A divided pond study. Report submitted to Metropolitan Mosquito Control District, December 1991.

Host, G.E., H.M. Rauscher, J.G. Isebrands, D.I. Dickmann, R.E. Dickson, T.R. Crow and D.A. Michael. 1990. The Microcomputer Scientific Software Series #6: The ECOPHYS User's Manual. USDA Forest Service Gen. Tech. Rept. NC-141. St. Paul, MN.

Host, G.E., S. Westin, W. Cole and K.S. Pregitzer. 1989. The microcomputer scientific software series #5: The BIOMASS User's Manual. USDA Forest Service North Central Forest Experiment Station, Gen. Tech. Rept. NC-127. St. Paul, MN.

Johnson, L.B. 1990. General Aquatic Ecology. Pp. 68-74 in D.W. Webb (ed.), Current and Selected Bibliographies on Benthic Biology. North American Benthological Society Bulletin.

Johnson, L.B. 1989. General Aquatic Ecology. Pp. 65-73 in D.W. Webb (ed.), Current and Selected Bibliographies on Benthic Biology. North American Benthological Society Bulletin.

Johnson, L.B. 1988. General Aquatic Ecology. Pp. 59-65 in D.W. Webb (ed.), Current and Selected Bibliographies on Benthic Biology, 1987. North American Benthological Society Bulletin.

Johnson, L.B. 1987. General Aquatic Ecology. Pp. 63-68 in D.W. Webb (ed.), Current and Selected Bibliographies on Benthic Biology. North American Benthological Society Bulletin.

Johnston, C.A. 1990. Literature pertaining to the environmental impacts of turfgrass management. NRRI Technical Report NRRI/TR-90/13.

Johnston, C.A. 1988. Productivity of wet soils: Biomass of cultivated and natural vegetation. Oak Ridge National Laboratory Report #ORNL/Sub/84-18435/1.

Johnston, C.A., B. Allen, J. Bonde, J. Salés and P. Meysembourg. 1991. Land use and water resources in the Minnesota north shore drainage basin. NRRI Technical Report NRRI/TR-91/07.

Johnston, C.A., N.E. Detenbeck, and G.J. Niemi. 1990. The cumulative effect of wetlands on stream water quality. NRRI Technical Report NRRI/TR-89/1.

Johnston, C.A., T. Johnson, M. Kuehl, D. Taylor, and J. Westman. 1990. Critical review of the effects of freshwater wetlands on water quality. NRRI Technical Report NRRI/TR-90/15. University of Minnesota, Duluth.

McNaught, D. and R. Carlson (PIs), and R. Axler, N. Detenbeck, R. Hicks, C. Johnston, G. Parker and M. Whiteside (Co-PIs). 1991. Land use impacts on Lake Superior. Final report submitted to Legislative Commission on Minnesota Resources. July 1991.

Mladenoff, D.J. 1989. Biodiversity. In: Emerging Environmental Issues. Minnesota State Planning Agency.

Mladenoff, D.J. and P. Mires. 1990. Final Report. Feasibility study of a GIS-based approach to monitoring toxics in western Lake Superior. Report to National Park Service, Apostle Islands National Lakeshore. 52 pp.

Mladenoff, D.J., D.P. Poe and L.R. Drewes. 1989. Development of processes and strategies for elimination of dioxins associated with bleached kraft pulp. Final Report. Legislative Commission on Minnesota Resources.

Morton, P. and J. Ameal. 1985. Saline waters as indicators of economic mineralization. Report to Minnesota Department of Natural Resources, Division of Minerals. Report 241-1.

Niemi, G.J., R. Axler, J.M. Hanowski, A.E. Hershey, R. Regal, L.J. Shannon and M.C. Whiteside. 1990. Evaluation of the effects of methoprene and Bti on non-target organisms: a summary of before-and-after sites in Western Wright County. Report to Metropolitan Mosquito Control District. 112 pp.

Niemi, G.J., R.P. Axler, J. Hanowski, A. Hershey, L. Shannon and M. Whiteside. 1989. Evaluation of the effects of mosquito control agents on non-target species in Metropolitan Mosquito Control District wetlands. Report to Metropolitan Mosquito Control District. 170 pp. + appendices.

Niemi, G.J., R. Caple, J. Hanowski, A.E. Hershey, L.J. Shannon and M.C. Whiteside. 1987. Evaluation of the effects of methoprene and BTI (Bacillus thuringiensis israelensis) on non-target species and communities in Metropolitan Mosquito Control District wetlands: year 1 progress report. Report to Metropolitan Mosquito Control District.

Niemi, G.J. and J.M. Hanowski. 1986. ELF communication system ecological monitoring program. In: Compilation of 1985 annual reports of the Navy ELF communication system ecological monitoring program. Vol. 3, Section J. National Technical Information Service. Technical Report E065499-26.

Niemi, G.J., K.B. Lodge, P. Morton and R. Caple. 1986. Multivariate model development for fiber carcinogenicity and the bioavailability of fine particles. Final Report to the U.S. Environmental Protection Agency, CR812042.

Niemi, G.J., R.J. Naiman and J. Pastor. 1988. Factors controlling the recovery of aquatic systems from disturbance, four parts. Report to the U.S. Environmental Protection Agency. Cooperative Agreement No. CR-813180.

Niemi, G.J. and R.R. Regal. 1985. Statistical analysis and computerized integration of structure-activity relationships for industrial chemicals. Final report to the U.S. Environmental Protection Agency, CR810824. 74 pp.

Niemi, G.J., R.R. Regal, D.D. Vaischnav and G.D. Veith. 1985. A preliminary model to predict biodegradability from chemical structure. Pp. 121-124 in Workshop on biodegradation kinetics. October 1983. U.S. Environmental Protection Agency, Navarre Beach, FL. EPA/600/9-85/018.

Owen, C. and R. Axler. 1991. Analytical chemistry and quality assurance procedures for natural water samples. NRRI Technical Report NRRI/TR-91/05.

Pastor, J. 1989. Nutrient cycling in aspen ecosystems. Pp. 21-38 in R.D. Adams (ed.), Aspen Symposium '89. U.S. Forest Service General Technical Report NC-140.

Pastor, J. and W.M. Post. 1985. Development of a linked forest productivity-soil process model. ORNL/TM-9519.

Rauscher, H.M., D.A. Perala and G.E. Host. 1990. An aspen forest management advisory system. In: R.D. Adams (ed.), Proceedings of Aspen Symposium '89. USDA Forest Service North Central Forest Experiment Station, Gen. Tech. Rept. NC-140. St. Paul, MN.

Richards, C. 1991. A preliminary assessment of benthic algal communities and physical habitat at several locations within the Minnesota River watershed. CWE Technical Report 78. Submitted to Minnesota Pollution Control Agency.

Richards, C. 1991. An overview of ecological assessment and restoration tools. In: Workshop on the water quality based approach for point source and nonpoint source controls. Meeting Summary. Environmental Protection Agency, Washington, DC. EPA 503/9-92-001.

Richards, D., P.J. Cernera, M. Ramey and D. Reiser. 1989. Utilization of off-channel dredge ponds to increase juvenile chinook salmon rearing habitat. Pp. 157-164 in D.G. Walker, D.B. Powder and M.W. Pole (eds.), Reclamation: A Global Perspective. Alberta Land Conservation and Reclamation Council. Report No. 89-2.

Rothstein, A., C. Hagley and G.J. Niemi. 1989. Fox River/Green Bay Red-winged Blackbird study, 1988-1989. Report submitted to U.S. Environmental Protection Agency Environmental Research Laboratory, Duluth.

Schubauer-Berigan, J.P. 1991. The formation of acid volatile sulfide (AVS) in sediments. Technical Report to U.S. EPA, ERL-Duluth. 31 pp.

Software Development

1. POLLY, a computer program written in Pascal, is capable of calculating some ninety topological indices for molecules.

Developed by Dr. Subhash C. Basak in collaboration with:

Dr. Donald K. Harriss
Professor of Chemistry
University of Minnesota-Duluth
Duluth, MN 55812

and

Dr. Vincent R. Magnuson
Professor and Head
Department of Chemistry
University of Minnesota-Duluth
Duluth, MN 55812

2. GENETOX. CAN, a computer program written in MINTER, is capable of classifying and predicting genotoxic potential of chemicals.

Developed by Dr. S. Basak in collaboration with:

Dr. Gilman D. Veith
Director-Environmental Research Laboratory
U.S. Environmental Protection Agency
6201 Congdon Blvd.
Duluth, MN 55804

Bob Hunter, developer of MINTER

3. TICPAC, a computer software capable of calculating octanol-water partition coefficient (K_{ow}) of chemicals directly from structure.

Developed by Dr. S. Basak in collaboration with:

Gerald J. Neimi
Greg Grunwald
Natural Resources Research Institute
University of Minnesota, Duluth
5013 Miller Trunk Highway
Duluth, MN 55811

and

Gilman D. Veith
U.S. Environmental Protection Agency
Environmental Research Laboratory
6201 Congdon Boulevard
Duluth, MN 55804

4. Fishfood, a program to calculate phosphorus inputs into lakes as a result of food loss, egestion, and excretion in net pen aquaculture systems.

Developed by George Host, Craig Tikkanen, Michael McDonald and Rich Axler.

5. Compost, a computer program written in QuickBASIC, developed to calculate amounts of turkey or pig manure to achieve a target C/N ratio in a peat-based composting system.

Developed by George Host, Tom Levar and Tim Hagen.

6. ASPEN-FMS, an expert system that advises a user on silvicultural treatments for aspen stands of given age, site quality, stocking, and management objectives.

Developed by H.M. Rauscher, D.A. Perala
Forestry Sciences Laboratory
1831 Highway 169 East
Grand Rapids, MN 55744

G. Host

7. LINKAGES, a computer program written in FORTRAN and CH to simulate changes in forest productivity, soil fertility, and species composition in response to management and climate change.

Developed by John Pastor, David Mladenoff and Y. Cohen.

8. PAC-MOOSE, a geographic information system that simulates how animals should search for food given a map of landscape and different foraging rules.

Developed by Ron Moen, Y. Cohen and John Pastor.

**GRANTS RECEIVED BY THE CENTER FOR WATER AND ENVIRONMENT,
NATURAL RESOURCES RESEARCH INSTITUTE, 1985-1991.**

Environmental Chemistry

Bioavailability of chlorinated dioxins and related compounds. U.S. Environmental Protection Agency. K. Lodge and G. Niemi, Co-Principal Investigators. \$972,490. 9/86-3/90.

Structure-activity relationship (SAR) for anticonvulsant drug development. National Institutes of Health. S. Basak, B. Hunter, G. Niemi, L. Drewes, Principal Investigators. \$963,556. 9/30/90-9/29/93.

Assessment of environmental toxicity of chemicals from structure—a computational approach. U.S. Environmental Protection Agency. S. Basak and G. Niemi Co-Principal Investigators. \$297,456. 5/89-5/91.

Development of processes and strategies for elimination of dioxins associated with the manufacture of bleached kraft pulp. Legislative Commission on Minnesota Resources. D. Mladenoff, Principal Investigator. \$147,000 to NRRI (\$294,000 total award). 7/87-6/89.

Field investigation of food chain and game fish accumulations of dioxin from incinerator emissions. Legislative Commission on Minnesota Resources. S. Eisenreich, D. Swackhammer (UM-Minneapolis), K. Lodge, Co-Principal Investigators. \$266,000. 7/89-6/91.

Acid deposition: chemical analyses for Thrush Lake Liming Project. Minnesota Department of Natural Resources. R. Axler, J. Ameel, Co-Principal Investigators. \$268,188. 1/86-12/90.

The physical-chemical and related analytical aspects of the aquatic-based toxicological assessment of contaminated freshwater sediments and their associated water. U.S. Environmental Protection Agency. K. Lodge, Principal Investigator. \$259,250. 10/90-9/93.

Structure-Activity Relationships Consortium (SARCON). Exxon Corporation, Ciba-Geigy Corporation. G. Niemi, Principal Investigator. \$90,000. 1/90-12/91.

Assessment of environmental toxicity of chemicals from structure: a computational approach. U.S. Environmental Protection Agency. S. Basak and G. Niemi, Co-Principal Investigators. \$70,000. 5/89-5/91.

Software development-prediction model for carcinogenicity and mutagenicity of organic chemicals. Greater Minnesota Corporation. G. Niemi and S. Basak, Co-Principal Investigators. \$50,000. 12/88-10/89.

Software development-predictive model for carcinogenicity and mutagenicity of organic chemicals. Minnesota Technology, Inc. S. Basak, Principal Investigator. \$40,000. 11/89-6/91.

The measurement of the 1-octanol/water partition coefficient (log P) for thirteen acrylates. The Chemical Manufacturers Association (CMA). \$26,823. 7/90-12/91.

Water quality criteria analysis. University of Wisconsin-Superior/U.S. Environmental Protection Agency. G. Host and R. Regal, Principal Investigators. \$24,000. 10/91-9/92.

Calculation of advisory acute toxicity values. U.S. Environmental Protection Agency. G/ Host and R. Regal, Principal Investigators. \$23,000. 1/90-6/92.

Modeling trophic transfer of contaminants in Lake Superior. The Graduate School, University of Minnesota. M.E. McDonald, Principal Investigator. \$14,000. 1989-1991.

Acid deposition: chemical analysis of Thrush Lake (1991-1992). Minnesota Department of Natural Resources. R. Axler and J. Ameal, Principal Investigators. \$12,500. 9/91-6/92.

Evaluation of biodegradation potential for six organic compounds. Eli-Lilly Company. G. Niemi, Principal Investigator. \$300. 1988.

Ecosystem Studies

Land Resources

Monitoring the effects of ELF antenna system on bird species and communities. J. Hanowksi. Department of Navy through Illinois Institute of Technological Research. G. Niemi, Co-Principal Investigator. \$960,495. 6/84-10/94.

Effects of changes in the forest ecosystem on the biodiversity of Minnesota's northern forest birds. Legislative Commission on Minnesota Resources. L. Pfannmuller (MDNR), G. Niemi and D. Mladenoff, Co-Principal Investigators. \$278,754 to NRRI (\$500,000 total award). 7/91-6/93.

Effects of large mammal browsing on the dynamics of northern ecosystems. National Science Foundation. J. Pastor and R.J. Naiman, Co-Principal Investigators. \$258,645. 2/87-7/89; J. Pastor and D. Mladenoff, Co-Principal Investigators. \$419,170. 4/90-3/92.

Reconstructing forest stand histories and soil development from paleoecological evidence. National Science Foundation. M. Davis (UM-Minneapolis), J. Pastor, Co-Principal Investigator. \$122,842 to NRRI (\$405,000 total award). 1/87-8/90.

A cooperative facility for research on the ecology of spatial heterogeneity. Biological Centers Program, National Science Foundation. C. Johnston, J. Pastor, Co-Principal Investigators. \$354,342. 11/88-4/91.

The use of fractal and chaos theory to verify, simplify, and extend forest ecosystem models. National Science Foundation. J. Pastor, Y. Cohen (UM-Minneapolis), Co-Principal Investigators. \$220,975. 3/91-2/93.

The relationship between heavy metal biogeochemistry and airborne spectral radiometry as an exploration method. Legislative Commission on Minnesota Resources. J. Pastor and S. Hauck, Co-Principal Investigators. \$250,000. 7/89-6/91.

Development of biocriteria for regional watersheds through integrated watershed and reach-scale analyses. Environmental Protection Agency. C. Richards, G. Host, L. Johnson, Co-Principal Investigators. \$248,000. 8/91-7/94.

Regional modelling of trace gas production in boreal ecosystems. NASA (subcontract from Colorado State University). C. Johnston and J. Pastor, Co-Principal Investigators. \$209,458. 7/89-12/91.

Changes in forest carbon storage with intensive management and climatic change. Department of Energy. J. Pastor, Principal Investigator. \$93,567. 7/86-6/88.

Structure and function of regional landscapes. USFS North Central Forest Experiment Station. D. Mladenoff, G. Host, and T.R. Crow (US Forest Service), Co-Principal Investigators. \$89,696. 9/91-3/92.

Global change Distinguished Postdoctoral Fellowship. U.S. Department of Energy. Scott Bridgman, Principal Investigator. \$77,000. 9/91-9/93.

Sediment contamination and bioaccumulation in wildlife: An experimental approach using tree swallows. U.S. Environmental Protection Agency. G. Niemi, M.E. McDonald and D. Beaver (Michigan Tech. University), Co-Principal Investigators. \$53,000. 9/91-9/92.

Modeling impacts of CO₂, ozone, and climate change on tree growth: an ecophysiological whole-tree approach. U.S. Forest Service, Northern Forests Global Change Program. G. Host, J. Isebrands, and M. Rauscher (NCFES) Principal Investigator. \$50,000. 10/91-9/93.

Minnesota old-growth forests: characterization and identification. Legislative Commission on Minnesota Resources. K. Rusterholtz (MDNR), D. Mladenoff, Co-Principal Investigators. \$150,000. 7/91-6/93.

Response of northern ecosystems to global climate change. U.S. Department of Energy. J. Pastor, Co-Principal Investigator. \$45,150. 10/88-7/89.

Caribou habitat assessment of northern Minnesota. North Central Caribou Corporation and U.S. Forest Service. J. Pastor and D. Mladenoff, Co-Principal Investigators. \$40,000. 2/91-4/93.

Monitoring bird populations in Minnesota's national forests. North Central Forest Experiment Station; Chippewa National Forest, Superior National Forest, U.S. Forest

Service and U.S. Fish and Wildlife Service. G. Niemi, J. Hanowski, Co-Principal Investigators. \$40,000. 4/91-12/93.

Geographic Information System plan for Voyageurs National Park. National Park Service. C. Johnston, Principal Investigator. \$39,410. 9/87-11/88.

A landscape approach to biological diversity management using geographic information systems and a forest succession model. The U.S. Forest Service and the Nature Conservancy. D. Mladenoff and J. Pastor, Co-Principal Investigators. \$34,000. 3/89-12/91.

Generic environmental impact statement: Timber harvesting and management in Minnesota. Jaako Pöyry Consulting. G. Niemi and J. Hanowski, Principal Investigators. \$27,000. 5/91-4/92.

GIS for the Superior National Forest. Superior National Forest. G. Host, L. Johnson, J. Pastor, Co-Principal Investigators. \$20,000. 8/91-6/92.

Modelling impacts of CO₂, ozone, and climate change on tree growth: An ecophysiological whole-tree growth process approach. G. Host, Principal Investigator. \$17,000. 9/91-9/92.

Monitoring post-impact bird populations and vegetation at the Biwabik wetland treatment area. J. Baker Engineering. G. Niemi, J. Hanowski, and D. Schimpf, Principal Investigators. \$14,434. 1/89-12/89.

Ecological classification system legend development for long-term site productivity study plot location. Chippewa National Forest. G. Host, D. Shadis (CNF), and D. Alban (NCFES), Principal Investigators. \$12,600. 7/91-6/92.

Interregional validation of ECOPHYS, an ecophysiological growth process model for poplar. Department of Energy. G. Host, Principal Investigator. \$12,000. 8/91-6/92.

Birds and vegetation at a proposed wetland treatment area, Biwabik. Minnesota Pollution Control Agency. G. Niemi, J. Hanowski, and D. Schimpf, Principal Investigators. \$9,500. 1/87-12/87.

Effects of soil compaction and organic matter removal on long-term site productivity and ground-flora diversity. USDA Forest Service. G. Host, Principal Investigator. \$9,000. 6/90-9/92.

Assessment of effects of aspen thinning on breeding birds and small mammal populations in northern Minnesota. Bioproducts/LCMR. G. Niemi, J. Hanowski, and D. Christian, Principal Investigators. \$7,500. 4/90-12/90.

A spatially-explicit habitat suitability model for black bear. USDA Forest Service. G. Host and L. Johnson, Co-Principal Investigators. \$3,700. 9/90-12/92.

Influence of leaf shape, area, and initiation rate on whole-tree photosynthesis in juvenile Populus: a simulation study. Tree Ideotype Working Group, International Energy Agreement (IEA). G. Host, Principal Investigator. \$3,500. 9/90-12/91.

Water Resources

Beaver, succession, and ecosystem dynamics across the boreal landscape. National Science Foundation. C. Johnston, J. Pastor, Co-Principal Investigator. \$660,000. 3/92-3/95.

Integrated study on the effects of mosquito control agents (methoprene and BTI) on non-target organisms in aquatic communities. Metropolitan Mosquito Control District. G. Niemi, Principal Investigator. \$159,992 to NRRI (\$634,000 total award). 4/89-12/94.

Predictive modeling and experimental design of lotic mesocosms. U.S. Environmental Protection Agency. G. Niemi and J. Perry (UM-St. Paul), Co-Principal Investigators. \$418,000 to NRRI (\$618,000 total award). 4/90-3/93.

Animal influences on the aquatic landscape: vegetative patterns, successional transition, and nutrient dynamics. Continuation proposal. National Science Foundation (subcontracted by the University of Washington). C. Johnston and J. Pastor, Co-Principal Investigators. \$283,369 to NRRI (\$387,909 total award). 3/89-8/92.

Hydrological control of nutrient cycling processes: animal influences on the aquatic landscape. National Science Foundation. R. Naiman, C. Johnston, Co-Principal Investigators. \$325,000. 2/86-7/88.

Biological communities of Lake Superior: The land/water interface. Legislative Commission on Minnesota Resources. R. Axler, N. Detenbeck, C. Johnston, R. Hicks (UM-Duluth), Co-Principal Investigators. \$240,000. 7/89-6/91.

Effects of disturbance on water quality functions of wetlands. U.S. Environmental Protection Agency. N. Detenbeck and C. Johnston, Co-Principal Investigators. \$223,907. 10/88-3/91.

Factors controlling the recovery of aquatic systems from disturbance. U.S. Environmental Protection Agency. G. Niemi, R. Naiman, and J. Pastor, Co-Principal Investigators. \$221,032. 4/86-1/89.

Limnological assessment of six mine pit lakes for aquaculture use. IRRRB and GMC (joint funding). R. Axler and M. McDonald, Co-Principal Investigators. \$168,763. 8/89-10/91.

Ecological research in Arctic Alaskan lakes. National Science Foundation. (Subcontracted from Marine Biological Laboratory, Woods Hole), M. McDonald, A. Hershey, Co-Principal Investigators. \$136,066. 1987-1992.

Commercial aquaculture: Implications for water quality in mine pit lakes. Minnesota Technology, Inc. and IRRRB (joint funding). R. Axler and M. McDonald, Principal Investigators. \$100,000. 7/91-6/93.

Lake and stream analysis (1990-1992). Minnesota Pollution Control Agency. R. Axler and J. Ameel, Co-Principal Investigators. \$96,200. 7/89-6/92.

Predicting Lake Superior shoreline erosion from coastal characteristics and historical trends. Minnesota Sea Grant Program. C. Johnston, Principal Investigator. \$86,750. 7/89-12/91.

Economic and technologic development for the crayfish industry in Minnesota. Greater Minnesota Corporation. M.E. McDonald, P. DeVore, C. Richards, and J. Skurla, Co-Principal Investigators. \$83,200. 7/89-6/91.

Crayfish and baitfish production in Minnesota rice paddies: economic, resource, and technologic aspects. Minnesota Technology, Inc. M.E. McDonald and C. Richards, Co-Principal Investigators. \$78,000. 7/91-6/93.

Evaluation of alternative approaches for quantifying the cumulative impact of disturbance on wetland systems. U.S. Environmental Protection Agency, Corvallis. C. Johnston, Principal Investigator. \$73,000. 7/87-9/88.

Assessing recovery of freshwater wetland water-quality status and function following physical or chemical disturbance. U.S. Environmental Protection Agency. \$63,787. 6/91-2/92.

Lake and stream analysis (1988-1989). Minnesota Pollution Control Agency. R. Axler and J. Ameel, Principal Investigators. \$59,100. 2/88-6/89.

Culture of walleye fingerlings in drainable ponds. Minnesota Technology, Inc. M. Swan, C. Richards, Co-Principal Investigators. \$46,875. 7/91-6/93.

Studies of nutrient inflow into the Peconic Bay system via submarine groundwater discharge. Suffolk County, NY. J. Schubauer-Berigan, Principal Investigator. \$40,000. 1/90-1/92.

Biological and chemical assessment of the Saginaw River watershed. Environmental Protection Agency. C. Richards, G. Host, J. Arthur (EPA), Co-Principal Investigator. \$39,995. 7/90-6/91.

Factors influencing the growth of algae in the Minnesota River watershed. Environmental Protection Agency. C. Richards, Principal Investigator. \$38,883. 7/90-6/91.

The influence of physical and chemical habitat on algal communities in the Minnesota River watershed. Legislative Commission on Minnesota Resources. C. Richards, Principal Investigator. \$32,748. 8/91-3/93.

International symposium on the role of ecotones in aquatic environments. National Science Foundation. R.J. Naiman, Principal Investigator. \$28,257. 2/88-4/89.

Economic and ecological feasibility of softshell crayfish aquaculture. Greater Minnesota Corporation. M.E. McDonald, G.J. Niemi, P.W. DeVore, J.A. Skurla, Co-Principal Investigators. \$28,000. 1989.

Fish community analysis in an effluent mixing zone. Western Lake Superior Sanitation District. C. Richards, Principal Investigator. \$22,181. 11/91-7/92.

Development of macro-invertebrate indicators for monitoring effects of nonpoint source pollution in wetlands. U.S. Environmental Protection Agency. N. Detenbeck, A. Hershey (UM-Duluth), Co-Principal Investigators. \$18,018.

Assessment of phytoplankton nutrient deficiency in northern Minnesota acid sensitive lakes. Minnesota Pollution Control Agency. R. Axler, Principal Investigator. \$15,000. 7/89-6/91.

Development of thermally enhanced walleye aquaculture. Minnesota Power. M.E. McDonald, Principal Investigator. \$13,100. 1987-1988.

Resource partitioning among Lake Superior forage fishes: Effects of changing dominance. Sea Grant. R.J. Naiman, M.E. McDonald, Co-Principal Investigators. \$10,000. 1/85-12/87.

Age and growth of Lake Superior Siscowet (*Salvelinus namaycush*) in Minnesota waters. Sea Grant. R.J. Naiman and M.E. McDonald, Co-Principal Investigators. \$10,000. 1/88-12/89.

A CTD/Transmissometer probe system for Lake Superior research. Cooperative project with the Graduate School of the University of Minnesota-Equipment Grant. R. Hicks, R. Axler, S. Eisenreich, A. Hershey, D. Swackhamer, and M. Whiteside, Co-Principal Investigators. \$10,000. 6/91.

Biological Characteristics of Miller Creek. South St. Louis County Soil Conservation District. C. Richards, Principal Investigator. \$8,501. 8/91-7/92.

Physical and biological survey of the Cloquet River. Fond Du Lac Reservation. C. Richards, Principal Investigator. \$7,903. 8/91-7/92.

Feasibility study: Monitoring the location and movement of toxic compounds in western Lake Superior with a Geographic Information System. National Park Service. D. J. Mladenoff, Principal Investigator. \$4,500. 11/89-8/90.

GIS database for Boulder Lake Reservoir. Minnesota Power. C. Johnston, Principal Investigator. \$2,060. 1991.